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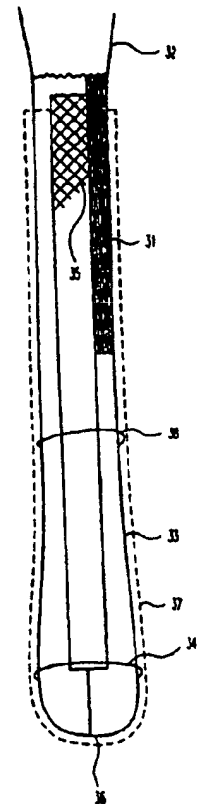
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(54) Title: FISHING EQUIPMENT (57) Abstract <p>The invention relates to a trawl with a special sorting net which can carry out sorting to a higher degree than known nets, hereby avoiding unnecessary and undesired catch and thus the losses connected herewith. A conventional trawl has been compared with the same trawl provided with the special sorting net. With the known trawl, the undesired catch was 70 %, while the new gave an undesired catch of only 1 %.</p> 		

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FISHING EQUIPMENT

The invention relates to fishing tackle, especially the fish catch-bag, a so-called cod-end, in a fishing trawl, and
5 of the kind where the towing direction of the trawl runs diagonally through the net meshes, and wherein there is inserted a special sorting part which, to a higher degree than the remaining part, is arranged to maintain the shape of the openings through which the fish which are required
10 to be sorted out by said openings shall pass.

What is thus described is a method for increasing the selectivity of the catch when fishing with large fishing tackle, a design of trawl for use in the execution of the
15 method, and a net material for the production of fishing tackle with the increased selectivity.

In order to achieve an optimum exploitation of the fish resources, fishery is regulated partly by quota arrangements
20 and partly via technical preservation measures. The technical preservation measures include standards for the mesh sizes of the nets, standards for how large a proportion of the haul may comprise incidental catch, and regulations concerning the minimum size of the fish and shellfish
25 caught in the nets.

The object of the standards regarding the mesh size is to avoid the landing of fish under a certain size. It is assumed that the mesh has a size-sorting effect, which solely
30 involves the mesh size in relation to the size of the fish. Therefore, efforts are made to achieve a size-sorting which may also serve as a kind of species sorting by adjusting the mesh to whatever kind of fish it is desired to catch. Fish which are smaller than the permissible minimum size
35 can escape from the net. It is important that the fish are not damaged by being sorted through the mesh. The hypo-

thesis behind the rules for mesh size is that the larger the mesh of the net, the greater the number and the size of fish permitted to escape, thus remaining part of the fish population and utilizing their potential of growth. However, the mesh size has proved to be a very unreliable basis for the estimation of the sorting abilities of the fishing tackle, and herewith the user's possibilities of fulfilling the current regulations regarding minimum size and incidental catch.

10 The stretch mesh size, i.e. the inner dimensions of an extended mesh, is a convenient number to use during the production of nets and in the control of fishing tackle by the authorities. However, what is important for the selectivity
15 is the opening of the mesh when the net is actually being used. The shape of the mesh can vary from quadratic to diamond-shaped to a narrow slot, where the length of the slot corresponds more or less to the so-called stretch mesh size. The shape of the mesh is determined by the towing
20 forces which influence the mesh during use, and herewith by the net's construction and conditions of use, and it is precisely these circumstances that explain the poor selectivity and the high death-rate in the incidental catch.

25 The death-rate is due to the fish in the trawl becoming so exhausted and suffering so much physical damage that they die either as a direct result of the damage, or later because the damage they have suffered makes it difficult for them to get food. Their exhaustion increases with the time
30 they spend in the trawl, and the damages are worsened with the difficulty of getting through the meshes and out of the net. With the normal trawl design, the catch-bag has a mesh opening which is down at approx. 10% of the mesh length, because the towing force in the longitudinal direction causes the meshes to close. Consequently, there is no possibility of escape for other than fish of very small dimen-

sions. There is no selection, and the main part of the incidental catch remains in the net. Gradually, as the catch is collected in the bottom of the trap, this will become pear-shaped because of the pressure from the catch. The mesh will hereby be opened more, and the larger fish can be squeezed out, but as a rule these will be dead or will have suffered great pressure damage or damages from contact with the net.

10 The object of the present invention is to achieve a very high degree of selectivity, e.g. when fishing with a trawl or seine-net. A second object is to ensure that the fish sorted-out are treated carefully during their passage in and out of the net, and thus have the possibility of survival and to form the basis for future catches. A third object is to produce fishing tackle where the size-sorting element can be delivered as a unit which can be incorporated into the tackle produced by the local net maker in accordance with the requirements and wishes of the individual users, but where the unit is produced in such a manner that users, authorities and competitors can be assured that the equipment in use has the prescribed characteristics with regard to selectivity and the ability to retain lawful catches.

25 A construction is known whereby a sorting plate of firm material is inserted in or just in front of the trawl bag, this being able to absorb compressive stresses so that the sorting holes can retain their size, but it has proved that this stiff construction gives rise to handling problems. Moreover, the sorting ability is limited, the reason being that the sorting plate can be mounted only on a short part of the trawl bag.

35 There is also known a construction with a catch-bag consisting of a net which is turned 45° in relation to the

normal, so that the trawl direction does not run diagonally through the mesh of the net, but along one of the sides in a mesh. This has naturally been attempted in an effort to hold the meshes fully open with a well-defined size at all times. However, it has proved that this construction results in a slipping of the knots due to the uneven loading of a given thread. With the commonly-used constructions, a given thread runs in a zig-zag manner transversely to the towing direction, i.e. crosswise or around the trawl bag.

5 This means that the towing force is distributed evenly over the thread through the individual knots in a given cross-section at right-angles to the towing direction. This is not the case with said known construction where the individual thread runs neither in the trawl direction nor in the transverse direction but in the diagonal direction, and thus this can give rise to a slipping of the knots either during the trawl or when the trawling net is being hauled in. The result is thus that the mesh does not maintain its size, particularly during the hauling-in, when the catch is hanging in the lowermost part of the bag and the bag is under great load. Consequently, attempts have been made to use the net in the manner described in the foremost part of the bag only, and a normally oriented net in the tail-part. This, however, considerably reduces the sorting ability, because it has been found that a large part of the sorting has to take place in the lowermost part of the bag. This trawl bag is not of the kind described here, which has the pulling force running diagonally through the mesh in the same manner as the net ordinarily used.

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There is also known a fishing-tackle construction which aims at holding all of the meshes in the bag distended by mounting a greater number of draglines which are intended to take up the longitudinal pulling forces in the bag. This hereby relieves the load on parts of the net itself, where its meshes are not exposed to diagonal forces which will

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close them. This bag suffers the disadvantage that it is special to produce and use and is not compatible with the prescribed standards for mounting to the remaining parts of the tackle. This is a problem for the individual fishermen
5 who must often have several nets depending on the kind of fish it is desired to catch. Moreover, the ability of the net to sort the fish is further limited, in that it has been found that the extent of load relief varies so that the relieved net undulates and flaps, and this movement de-
10 ters a large part of the undesired catch from seeking a way out through the mesh.

The object of the present invention is thus to provide a solution to the problem of sorting to be found with the
15 existing fishing tackles. It is also the object to show how a commonly known catch-bag can be made selective throughout the whole of its length, to present a sorting part for incorporation into known bags and a net material for use in said sorting part.

20 The catch-bag according to the invention is peculiar in that the sorting part is made up of one or more pieces of net which are arranged to retain the shape and the size of their meshes, and which are mounted in the catch-bag.

25 It will now be described how this can be realized in various ways:

The invention will be illustrated with a trawl as an example, but what is described can be used with the same advantages on other fishing tackle which comprises a catch-bag. The catch-bag is the rearmost end of the trawl and consists of a longitudinally extended bag. Its diameter, length and mesh size will depend of the desired species of fish, bot-
30 tom conditions, size of boat etc. A catch-bag can, for example, be 45 m in length and e.g. 10 m in circumference
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measured as stretched mesh at the leading end.

Because of the towing through the water, the mesh in most of the bag will be stretched out, so that most of the bag's surface consists of tightly-closed net meshes, where the distance from knot to knot transversely to the trawl direction is 10% or less of the mesh width. The closing of the mesh is held in balance by a force along the circumference of the bag, and which stems from the current of water which is pressed from the interior of the bag out through the net.

After numerous trials, it has now been found to be possible in such a catch-bag to insert a sorting window consisting of net which is mounted so that it is substantially slack and not loaded by the longitudinal towing forces.

It is surprising in itself that this is possible to achieve without interfering in any substantial manner with the normal construction of the trawl or its use and behaviour in the water.

One embodiment of the net is peculiar in that the dimension of the sorting net or nets is considerably greater in the trawl direction than in the transverse direction.

It is possible hereby to achieve a greater shape stability in the opening or in the "window" where a sorting net is to be placed. The explanation for this can be found in the unequal distribution of the forces which exist in the net when being trawled, where the pulling forces are considerably greater than the transverse forces. It is naturally of interest to obtain an opening which displays shape stability, and if the extent of the opening is greater in the trawl direction, the towing forces will be led around the opening without the consequence of large deformations other

places in the net in addition.

A preferred embodiment is peculiar in that it has at least one sorting net which has the shape of an elongated rectangle, and which extends mainly in the bag's longitudinal direction.

It is hereby possible to eliminate pulling forces in the sorting part, where all of the pulling forces are carried by the fully extended bag in a quite normal manner. The water flowing out from inside the bag will to a substantial degree pass through the longitudinal sorting net, and the pressure of the water in the bag will provide a transverse force which will hold the elongated sorting net lightly distended in the transverse direction, hereby maintaining its mesh size and shape during use.

It has also been found that an especially good sorting can be achieved with constructions where the sorting net has a curved shape around its longitudinal axis and appears as a rib on the outside of the catch-bag in the longitudinal direction.

In a preferred embodiment, the breadth of the sorting net measured in the number of openings formed by its mesh along the circumference of the catch-bag is 5-35% of the total number of mesh openings. With higher percentages, e.g. above 20%, it is preferred that the sorting net be divided into several narrow nets in order to disturb the water current as little as possible. For example, in a shrimping net, one could insert 6 narrow, longitudinal sorting nets.

The particularly preferred sorting net is divided into two, each of which is 7-15% of the total number of mesh openings, and which extend substantially throughout the whole length of the catch-bag. If the breadth of the sorting net

is made considerably larger than the above-mentioned 35%, it has been found that the shape of the trawl is disturbed.

5 A further development of this embodiment is peculiar in that the main net is reinforced in the area in front of the foremost part of the sorting net in order to lead the towing forces around the sorting net.

10 It is hereby achieved that the forces in the foremost part of the sorting net can be controlled in such a way that the sorting net can also be held distended in the foremost part, otherwise it will tend to fold together in the foremost part until all of the pulling forces around the front of the foremost part have been distributed out in the main
15 net.

The size and the shape of the sorting net's mesh can be safeguarded by fastening the sorting net along its periphery, at least in the longitudinal direction, to the
20 catch-bag in such a way that when the catch-bag is extended, as when in use, then the sorting net is secured to this with a mesh distance which corresponds to the mesh openings in the sorting net having the desired size. With meshes with 95 mm stretched, inside mesh openings, it is
25 possible, for example, to achieve that the sorting net is fully open if it is ribbed on the extended bag at a distance of approx. 70 mm.

30 A preferred embodiment is thus peculiar in that the edge of the sorting net is ribbed securely to the main net or parts thereof in a known manner.

It is hereby possible to modernize old trawls by quite simply incorporating the new technique in the old, well-
35 proven constructions.

Another embodiment is peculiar in that the edge of the sorting net is ribbed to a line, or that the line is made an integrated part of the sorting net in another manner, e.g. by knotting or impregnation, and that this sorting net
5 "with frame" is inserted in a known manner into the catch-bag.

In another embodiment, the sorting net is ribbed or in another manner secured to a frame of extended net with a
10 mesh size which determines what size opening the mesh of the window is to have. This is in turn determined by the kind of fish it is desired to catch and which legal requirements are valid. For example, the window can be 6 mm
15 plaited polyester yarn with an internal stretched mesh size of 95 mm. The window is meshed together with 2-4 mm plaited nylon with 74 mm mesh, 6 meshes wide on the longitudinal
sides. By thus sewing the window's large mesh together with the smaller mesh of the frame, the result is that when the
20 frame is stretched, the meshes of the window will thus be open with an opening of 70-71 mm, which e.g. is appropriate for cod fishing in accordance with the current regulations regarding minimum size. When mounting in the catch-bag, the
6 meshes of the frame are hemmed over 3 meshes in the bag, which results in a frame which is stronger than the net in
25 the window and the net in the trawl, so that ruptures will be stopped.

A characteristic feature of the invention is that it permits the sorting window to be produced and controlled at
30 the factory in the form of sorting nets connected in an integrated manner with at least one longitudinal "frame", which ensures that the sorting net can be inserted in the catch-bag without the mesh of the sorting net changing shape.

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With a special embodiment, after the mounting of the

"frame" on the sorting net, an impregnation of the sorting window is carried out, whereby a kind of sealing is achieved which can certify that the frame has been mounted at the factory and will ensure a certain mesh opening of the sorting net during use.

What has been achieved hereby is an important precondition for being able to base a fishery regulation on the application of sorting nets. The essential factor here will be to ensure that the sorting net cannot be mounted so that its mesh is stretched and herewith closed more than that which corresponds to the approved found minimum size for the species of fish caught. As described above, this can be done by providing the sorting window with a frame of line or net which limits the extent to which the window can be stretched in the longitudinal direction. With yet a further embodiment, the stretching is limited by an edge of shorter half-mesh.

Another embodiment is peculiar in that in the edge of the sorting net there is a built-in seal, e.g. in the form of a sealing wire which extends along the edge and through the knots, and which can thereby ensure that the sorting net is original. In this manner, there can be introduced a hitherto-unknown form of fishery control which according to the present invention could be far more effective than that which exists.

With special embodiments it can be ensured that the sorting net maintains its guaranteed dimensions and possibly approved lifetime by using lines or yarns which are coloured in such a way that it can be seen whether or not the original rib distance has been maintained or whether the net's lifetime has expired. For example, this can be achieved when the moving of a knot will expose a piece of yarn of another - possibly undyed - colour, or when a coating layer

will have worn off at the expiry of the net lifetime.

The present invention offers the important advantage that the opening in the sorting net can be adjusted in accordance with what is to be fished. This can not be done if, for example, an attempt is made to use the so-called square-mesh net, but it is readily possible with the present sorting net where the bag's longitudinal direction runs diagonally through the mesh of the sorting net. When fishing for herring, the meshes of the sorting net will be mounted on the frame at a slightly shorter distance, so that the diagonal in the transverse direction of the mesh is the greater, corresponding to the cross-section of the herring which has greater height than width. When fishing for cod, the mesh openings are made square, corresponding to the cod's more round shape, and for flatfish the meshes of the sorting net will be mounted on the frame at a slightly greater distance, so that the openings in use become broader in the horizontal direction, corresponding to the flat cross-section of the fish. Finally, it is possible with the invention to use a sorting net with asymmetrical mesh, e.g. by making the window from net knotted with a shorter over-yarn (from the shuttle) and longer under-yarn (from the frame). The mesh openings hereby becomes almost guttiform. Such a net is mounted in the catch-bag turned 90° in relation to the bag's longitudinal direction, so that when the bag moves horizontally through the water, the guttiform stands vertically in the sorting window.

In a particularly advantageous embodiment, also for normal asymmetrical meshes, the sorting net's mesh is turned 90° as described above, in that it has been found hereby that the net meshes can better be held open in the desired shape.

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It is a well-known experience that when a catch-bag is in

use, there is more pull force in the uppermost part - the uppermost panel - than in the lowermost panel, and the known trawl construction is adjusted in accordance with this condition. Therefore, it is important that this balance is not disturbed when mounting the sorting windows. Here it has been found that it is a great advantage that the sorting windows according to the invention consist of sorting net where the bag's longitudinal direction runs diagonally through the meshes. This means that when the sorting windows are mounted between the upper and the lower panel in the catch-bag, any pull force which extends from the bag's upper panel can be transmitted directly through the diagonally-extending yarn of the sorting window down to the lowermost panel. The fact that a smaller part of the towing forces can be transferred to the lower panel through the yarns which extend in the direction of the force, results partly in the window not disturbing the shape of the bag, and partly that there is a transverse force which helps to hold both the outer shape of the sorting window and the mesh openings in a stable condition. This is an advantage compared with the case where a square-meshed window has been mounted, where the connection between the upper and the lower panels extends through yarn which stands at 90° in relation to the panels.

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According to a further development, the sorting net or nets can be stiffer than the main net, e.g. with regard to bending.

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According to a second development the sorting net or nets can be pre-stressed during the trawl.

According to a third and preferred further development, the sorting net or nets can in the main be tension-free, in that they are inserted in such a manner that in the main they do not transfer towing forces during the trawl.

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What is involved here are three different further developments, each of which can contribute towards maintaining the shape of the sorting net.

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In the first case the net is made stiff by reinforcement, either of the yarn itself or by giving it a stiffer coating.

- 10 In the second case it is pre-stressed, e.g. by virtue of the fact that the flow of water in the catch-bag will seek to expand the bag.

- 15 In the third case, efforts are made to make it tension-free.

All three arrangements can contribute to the maintaining of the shape of the sorting net, and also to preventing the flapping of the net in the current.

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In practice, there is nothing to prevent the use of more of the above-mentioned arrangements.

- 25 Yet another embodiment is peculiar in that a known trawl with a cross-section like a reclining ellipse is equipped with an extended, rectangular sorting net at the sides, i.e. where the curvature of the ellipse is greatest.

- 30 Another similar embodiment, where the catch-bag consists of an upper part and a lower part, and which in use has the shape of a reclining ellipse wherein two joints extend in the towing direction at the point where the curve of the ellipse is greatest, is peculiar by having a sorting net in the underpart immediately below and along each of the
35 joints.

It has been found that with such a net one can practically avoid undesired catch. To this can be added that this embodiment is particularly suitable for building into existing nets, because experience has shown that it does not in any way disturb the conditions of flow. It is not necessary to undertake renewed adjustments of the trawl after the sorting nets are mounted.

A sorting net according to the invention can be specially impregnated, e.g. with acryl latex or rubber latex. It has been found that such an impregnation is particularly decisive in achieving a good result. Firstly, the impregnation contributes towards the damping of the movement of the net itself, but also the damping of the movement of the individual meshes, and this is of great significance because otherwise the fish can be frightened away. Secondly, the impregnation contributes towards increased stiffness of the net mesh, and in this way a greater stability of shape is achieved - the net can better remember its shape. Thirdly, the fish slip easier through the net, and damages to the fish are hereby avoided to a higher degree.

The above-mentioned ability to remember its shape is an important feature of the sorting net. Even though the forces in the bag are in the main led around the sorting net, the sorting net will be exposed to incidental forces which stem from eddy currents, contact with the bottom and the like. This can result in the folding or closing of changing areas of the sorting net, but in order to achieve optimum function it is desirable that net can quickly straighten up again when the incidental forces cease.

In order to ensure this ability, the net can for example be made of normally twisted or plaited yarn of nylon or polyester, which is subsequently impregnated with an agent which ensures firmness of the knots and increases the net's

stiffness and elasticity. A preferred agent can be a curable latex, e.g. an acrylic latex which is hardened with a melamine formalin resin. The agent can also be a curable vinyl-pyridine resin which is hardened with a formaldehyde recorsinol resin. The agent can also be a two-component polyurethane rubber.

Particularly preferable agents are weather-resistant rubbers such as nitril rubber, which are bound to the net material by means of a vinyl pyridine latex.

When carrying out the impregnation it is important that a hinge effect does not arise at the knots, the reason being that these are inadequately impregnated on the inside. With a particularly preferred embodiment this is ensured by forcing the impregnation agent into the knots by using vacuum. With a particularly preferred embodiment where the net used is of nylon, it has been found surprisingly that a correspondingly good impregnation can be achieved by a thorough drying of the nylon net before the impregnation.

Impregnation can be carried out in several steps by applying several layers.

With a preferred embodiment, the hardening is carried out by heating to above 100°C for 1/2 to 5 hours while the net is stretched to the mesh shape which is required in the sorting part.

With a particularly preferred embodiment of the above, the net is suspended in a mesh shape which is stretched to a greater cross measurement than that which is desired during use.

With another version, the greater stiffness and elasticity is achieved by producing the sorting net of a material

which in itself possesses these characteristics. For example, the net can be made of monofilaments or of yarn with a core of a stiff material. It is important with these embodiments that the stiffness of the sorting net can be chosen
5 so that the catch-bag as a whole retains sufficient bendability to enable it to be handled in the normal manner during handling on the boat.

Finally, the sorting net according to the invention can
10 have a mesh orientation so that one of the mesh diagonals extends substantially parallel with the longitudinal direction of the catch-bag.

There is hereby achieved a very important advantage which
15 lies in the fact that the net can not be deformed, i.e. the knots in the net will not slip when the catch is being hauled in on the boat, which can otherwise sometimes be the case with a so-called square-mesh net.

20 The invention also relates to a method for the manufacture of a net according to the invention, and this method is peculiar in that:

- 25 1) it is determined by calculation or trials how that opening in which the sorting window is to be mounted will look or be deformed under the load which arises during the trawl,
- 30 2) it is correspondingly ascertained how the mesh opening of the sorting window must appear during use, depending on the kind of fish to be caught and which regulations are to be adhered to,
- 35 3) a sorting net is produced which has a contour and a mesh size corresponding to the findings under 1) and

2),

4) the panels of the catch-bag are stretched out as during the trawl, and the sorting window is secured in the opening so that it stands as determined under 1) and 2) when taken into use,

5) that a possible sealing is carried of this securement.

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In other words, what is involved is getting a sorting window mounted at some point in the catch-bag, and getting this window to work so that it not only sorts out the fish of a certain size, but also all of the fish below this certain size. Moreover, it must work again and again, i.e. the solution must be tenable. In the first place, what is involved is consequently to get an opening formed of such a shape that it does not have any influence on the tensions in the remaining part of the net. On the basis of an analysis of the tension ratios, i.e. the distribution of the pulling forces and the transverse forces (it should be noted that here the pulling forces are to be understood as the towing forces from the fishing vessel), it is realized that the least detriment to the force distribution is incurred by forming an elongated opening in the direction of the tow. It is further realized that such an opening can be made substantially tension-free, which in turn provides freedom for the building-in of a sorting net with the desired distension. Trials have shown that it is expedient for fish of a certain size to be desirable even to make the breadth of the sorting net considerably greater than the corresponding opening in the catch-bag during use, so that the sorting net's two long sides curve in towards each other and the sorting net sit like a bulge on the catch-bag.

It is interesting to note that one or more sorting nets which extend in the longitudinal direction is just what is needed. It has been found that under advantageous circumstances that this can reduce the undesired catch right down to 1%, whereas under the same conditions with normal catch-bags this would be up at 70%. The explanation is thought to lie in the fact that the fish swim forwards in the direction of movement inside the catch-bag before possibly being caught up by the bottom of the bag. During this swimming forwards, with the present construction, they have the possibility at any time to change course to the side and come through a sorting net extending longitudinally in the catch-bag.

The invention is explained in more detail with reference to the drawing, which shows a preferred embodiment, and with a description of the results achieved, where

fig. 1 shows a trawl rigged as during the tow,

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fig. 2 shows a catch-bag of known construction while being towed,

fig. 3 shows a bag with sorting window according to the invention,

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fig. 4 shows different shapes of mesh in the sorting net,

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fig. 5 shows a sorting window with a frame of finer mesh.

The trawl 1 in fig. 1 comprises three main parts; the arms 2, the body 3 and the catch-bag 4. The arms are often made of net of a large mesh size, and they serve primarily to

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frighten and lead the fish towards the middle of the main net. Here, the fish are led through the body of the trawl rearwards towards the catch-bag 4, which is that part which collects the catch and in the main determines what will be retained and what will be given the possibility of escape.

In fig. 2 is seen the situation in which a catch-bag of known construction is towed over the bottom, and the catch is mixed. Here, 11 is the upper panel of the bag, 12 is its lower panel and 13 is the connection where the catch-bag is secured to the body 14 of the trawl. Although a bag with a relatively large mesh is used, the meshes will be more or less closed, especially in the middle of the bag, due to the longitudinal towing force. In the lower part, when hauled in, the bag is more distended by the catch, and here the mesh is larger so that smaller fish are pressed out, but are dead or dying due to mechanical damages or exhaustion.

Further forward in the catch-bag, a small degree of sorting takes place so that, for example, herring seek upwards and cod towards the bottom, but by far the greater part of the individual fish which escape are damaged or extremely exhausted.

25

Fig. 3 shows the lower or rearmost end of a trawl with a catch-bag according to an embodiment of the invention. The bag 31 is connected to the existing main part 32, of which only a small part is shown, but this part is of conventional construction. At the rear, the bag 31 ends in the so-called lift 33, which comprises the rearmost two meters of the bag 31. Around the rearmost end of the bag 31 there is mounted a limiting strap 34 at a distance of 47 cm from the bottom of the bag. A sorting net 35 is arranged at each side of the bag 31. The length of this sorting net 35 is 5.2 m and it has its rear limitation 47 cm from the bottom

strap 36. Around the lift 33 there is arranged a wear-covering 37 which is shown schematically, and which extends 2 m forwards from the bottom but leaves the sorting areas free. The bag 31 consists of a plaited polyester 4-6 mm mesh 105
5 with an internal stretch dimension of 95 mm. The opening in the bag 31 is 100 meshes and at the lift 33 it is similarly 100 meshes. The sorting net 35 is 77 cm broad at 100% open mesh, and is ribbed on a 12 mm Danline with rib distance 70 mm corresponding to 100% open mesh. The sorting net 35 is
10 plaited nylon which is impregnated four times with a hardenable acryl latex, and which is fixed dimensionally and in shape by heat treatment at 125°C. The lift strap 38 lies in plastic rings 2.33 m from the bottom. The wear-coat is double-4-plaited polyester with an internal mesh of 210 mm.

15

Fig. 4 shows different mesh shapes in the sorting net. They are all shown with vertical orientation as they will stand in the sorting window during use, and the tow direction is shown with arrows. Here, 41 is a mesh which is mounted so
20 that the two diagonals 42 and 43 are equal in length. This gives a quadratic opening corresponding to that suitable, for example, for the sorting of cod. 44 is a net which, when being mounted in frames or possibly directly in the trawl, has had the vertical diagonal 43 made longer than
25 the horizontal 42, corresponding to a sorting net for e.g. herring.

Finally, 45 shows a section of a sorting window which is made of a net in which every other thread is shortened
30 down, so that the mesh is unsymmetrical. Moreover, this net is turned 90° in relation to the normal, so that the net's depth lies transversely to the bag's longitudinal direction.

In fig. 5 is shown a sorting window with a frame 51 of
35 finer mesh joined to the stretched sorting net 52.

EXAMPLE

The trawl shown in fig. 3 has been compared with two other
5 trawls of more or less the same size, but without the sorting net according to the invention. One of these trawls had a bag of approved 105 mm internally stretched mesh, while the other was a 36 mm herring bag. During cod fishing under controlled circumstances in the Baltic, both nets
10 provided a catch of approx. 3,000 fish in 15 2-hour tows. In both cases, the undesired catch was around 70%, and the remainder were cod of the permissible size above 34 cm.

During corresponding fishing with a trawl according to the
15 present invention, and with a sorting net with a mesh of 95 mm, approx. 800 fish were caught which were of approved size, while the undesired catch amounted to only 1%.

From this it will be seen that the known catch-bags have no
20 sorting characteristics, and that it is not possible to influence the size of the undesired catch by regulation of the mesh size.

In comparison, when a catch-bag with sorting net according
25 to the invention is used, the same useful haul is achieved with only 1% undesired catch.

It has been found that a fishing net according to the invention provides an astonishingly constant selectivity over
30 a long period of use.

It has also been found that if efforts have been made to arrange a tension-free and herewith a slack sorting net, then it is important to have stiffness built into the
35 actual net mesh, hereby avoiding that the sorting net will to flap in the water current, which is a condition for the

fish daring to swim through the net.

Finally, another important property of a "diagonal" sorting net according to the invention has been found in connection with a somewhat filled catch-bag. Such a sorting net, where the mesh is oriented in the same manner as the mesh of the catch-bag, can better transfer and distribute the forces than the so-called "quadratic" net, where the mesh is turned 45 degrees, and where the dominating forces, the pulling forces, run along one side of the rectangle.

With a sorting net with diagonal mesh according to the invention in a rather full catch-bag which has assumed a pear shape, the distribution of the forces takes place in a suitable manner over the filled part, without that part of the sorting net which lies up front in the towing direction becoming deformed. The fishing net hereby remains perfectly functional up until the end, i.e. until the catch-bag becomes completely full.

20

C L A I M S

1. Fishing tackle, particularly the catch-bag in a fishing trawl of the kind where the towing direction runs diagonally through the meshes of the net in the catch-bag, and wherein there is inserted a special sorting part which to a higher degree than the remaining part is designed to maintain the shape of the openings through which the fish determined to be sorted out shall pass, characterized in that the sorting part consists of one or more nets which are arranged to maintain the shape and the size of the mesh.
2. Fishing tackle according to claim 1, characterized in that the dimension of the sorting net or nets is considerably greater in the towing direction than in the transverse direction.
3. Fishing tackle according to claim 1 or 2, characterized in the main net is reinforced in the area in front of the foremost part of the sorting net in order to lead the pulling forces around the sorting net.
4. Fishing tackle according to claim 1, 2 or 3, characterized in that the main net is reinforced in the area at the side of the sorting net, e.g. by placing this adjacently up to a longitudinal reinforcement, e.g. a longitudinal net joint.
5. Fishing tackle according to claim 1, 2, 3 or 4, characterized in that a sorting net or -panel is provided, at least at the longitudinal sides, with a frame of net material or line which when being used is extended and determines the opening of the mesh in the sorting net.
6. Fishing tackle in the form of a sorting net or -panel

for mounting in the catch-bag of a trawl, characterized in that the net or the panel is provided with an integrated frame which is arranged to ensure that the sorting net or - panel when in use maintains a prescribed mesh opening.

5

7. Fishing tackle according to one or more of the claims 1-6, characterized in that the edge of the sorting net is ribbed firmly to the main net or parts thereof in a manner known by itself.

10

8. Fishing tackle according to one or more of the foregoing claims, characterized in that a seal is built into the edge of a sorting net, e.g. in the form of a sealing thread which extends along the edge and through the knots, and
15 which can hereby ensure that the sorting net is original.

9. Fishing tackle according to claim 2 and possibly one or more of the claims 3-8, characterized in that a known catch-bag with a cross-section which when in use has the
20 shape of a reclining ellipse is equipped with a sorting net at the sides, i.e. where the curve of the ellipse is greatest.

10. Fishing tackle according to claim 2 and possibly one or
25 more of the claims 3-8, and where the catch-bag consists of an upper part and a lower part, which in use has the shape of a reclining ellipse, in that two joints extend in the towing direction where the curve of the ellipse is greatest, characterized in that a sorting net is provided
30 in the under part immediately below and along each of the joints.

11. Fishing tackle according to one or more of the foregoing claims, characterized in that the sorting net or
35 nets have a greater strength than the main net, e.g. bending strength and/or tensile strength.

12. Fishing tackle according to one or more of the fore-
going claims, characterized in that the sorting net or
nets have greater elasticity than the main net and are pre-
5 stressed during the trawl.

13. Fishing tackle according to one or more of the fore-
going claims, characterized in that the sorting net or
nets are substantially tension-free, and in that they are
10 inserted in such a manner that in the main they do not
transfer pulling forces during the trawl.

14. Fishing tackle according to one or more of the fore-
going claims, characterized in that the mesh of the sor-
15 ting net or nets has a shape which corresponds to the fish
which are to be sorted out, i.e. rhomboid if the fish to be
sorted are flatfish, and a more quadratic shape if the fish
to be sorted are roundfish.

20 15. Fishing tackle according to one or more of the fore-
going claims, characterized in that the cross-section of
the threads in the sorting net is not circular.

16. Fishing tackle according to one or more of the fore-
25 going claims, characterized in that the sorting net has
such a mesh orientation, so that one of the mesh diagonals
runs substantially parallel with the longitudinal direction
of the catch-bag.

30 17. Fishing tackle according to one or more of the fore-
going claims, characterized in that the sorting net or
nets extend mainly over the rearmost part of the catch-bag.

18. Fishing tackle according to one or more of the fore-
35 going claims, characterized in that the sorting net or
nets extend substantially over the whole length of the

catch-bag, preferably with substantially the same width.

19. Fishing tackle according to one or more of the foregoing claims, characterized in that the sorting net or
5 nets are specially impregnated, e.g. with acrylic latex or rubber latex.

20. Method for the manufacture of fishing tackle according to one or more of the claims 1-19 on the basis of a conventional trawl with catch-bag, characterized in that:
10

1) it is determined by calculation or trials how the opening in which the sorting window is to be mounted should look or is deformed under the load which arises
15 as a result of the trawl,

2) it is correspondingly determined how the mesh opening of the sorting window will appear during use, depending on the kind of fish to be caught and which
20 regulations are to be fulfilled,

3) a sorting net is produced which has a contour and a mesh opening corresponding to the findings under 1) and 2),
25

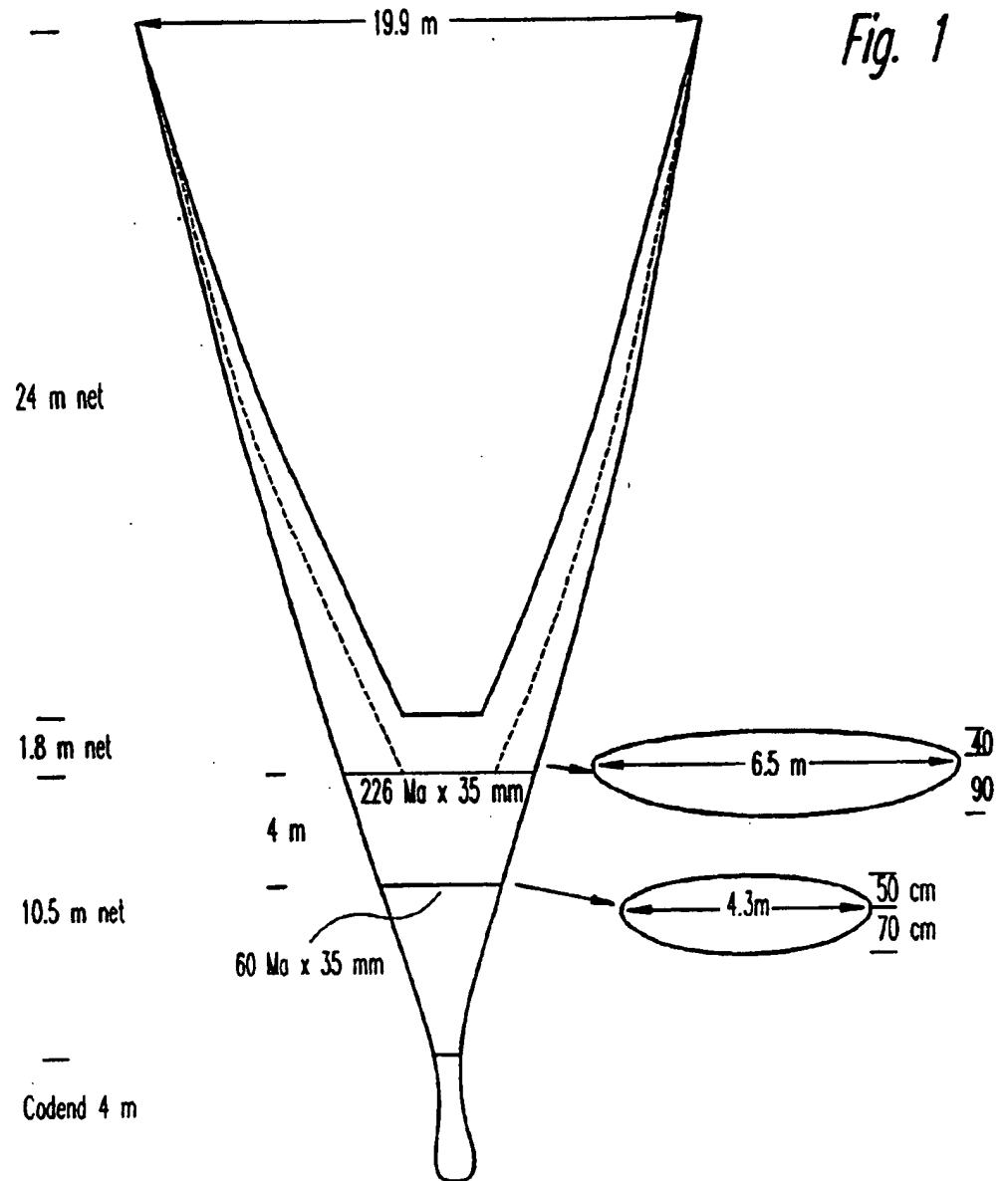
4) the panels of the catch-bag are stretched out as they are during the trawl, and a sorting window is fastened in the opening so that it comes to stand as determined under 1) and 2) when it is taken into use,
30

5) a possible sealing is carried out of this fastening.

21. Method according to claim 20, characterized in that it is used for the production of fishing tackle with several
35 sorting nets.

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Fig. 1



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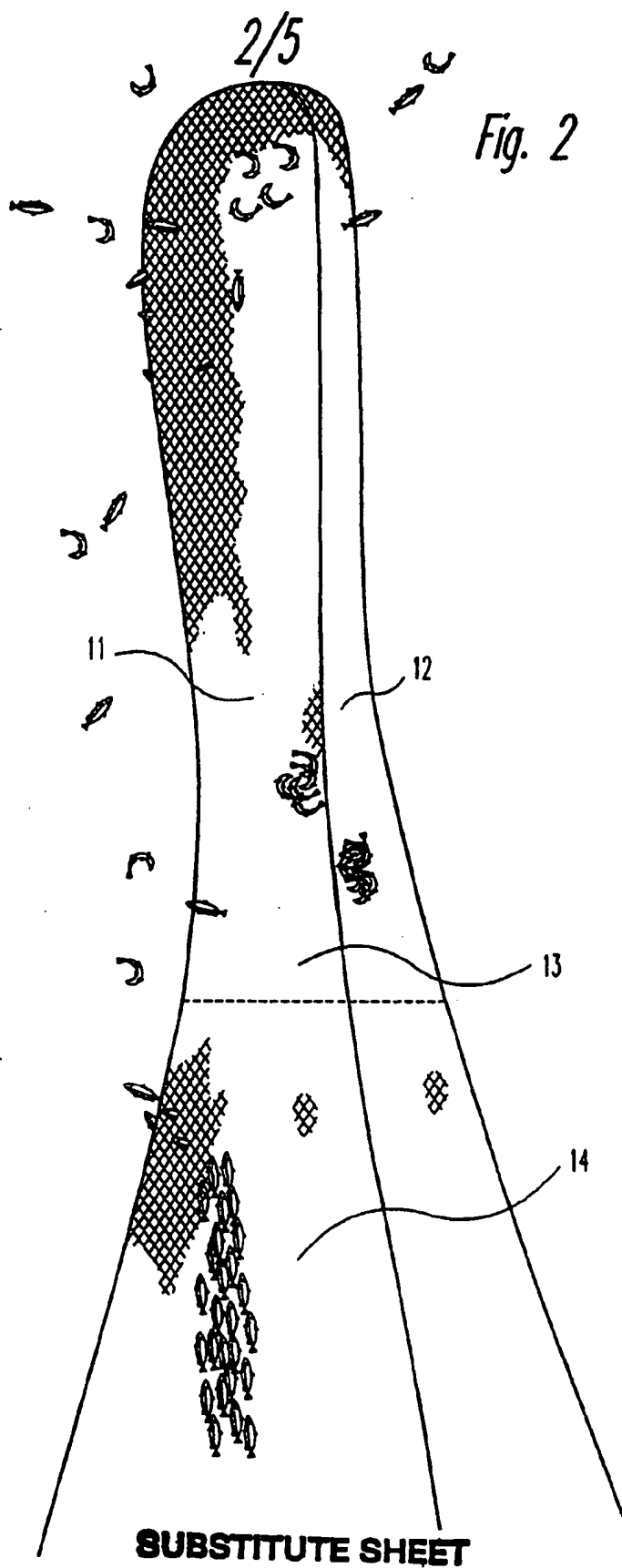
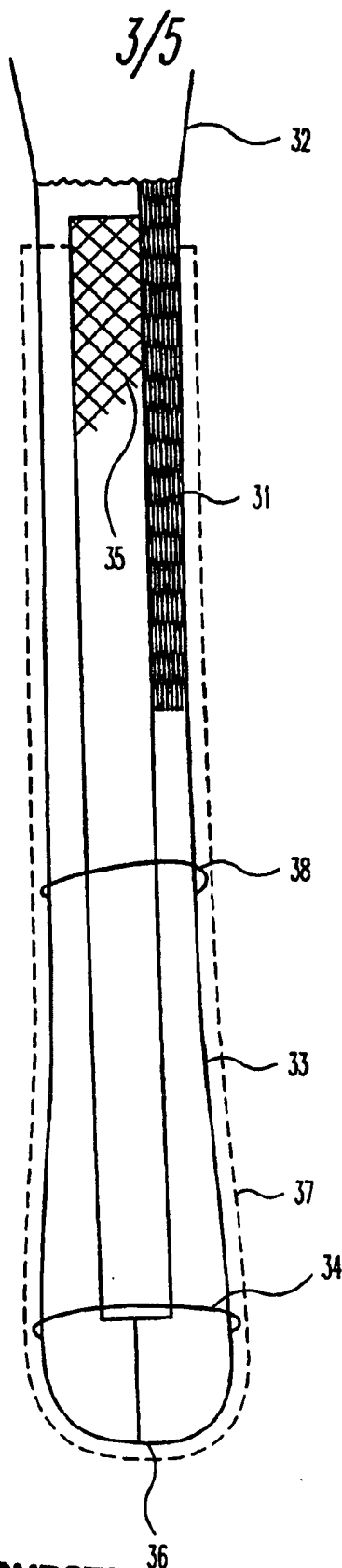


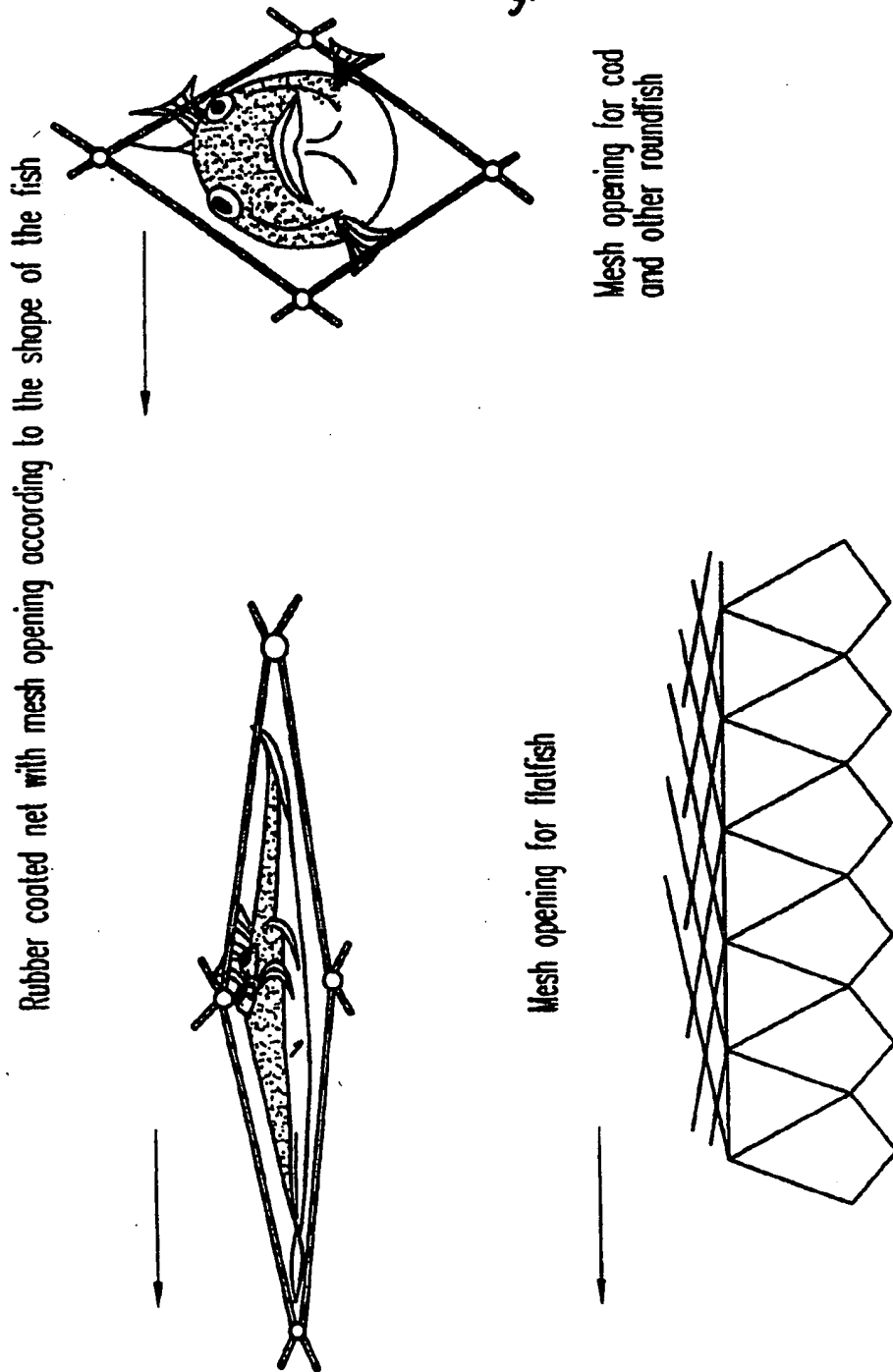
Fig. 3

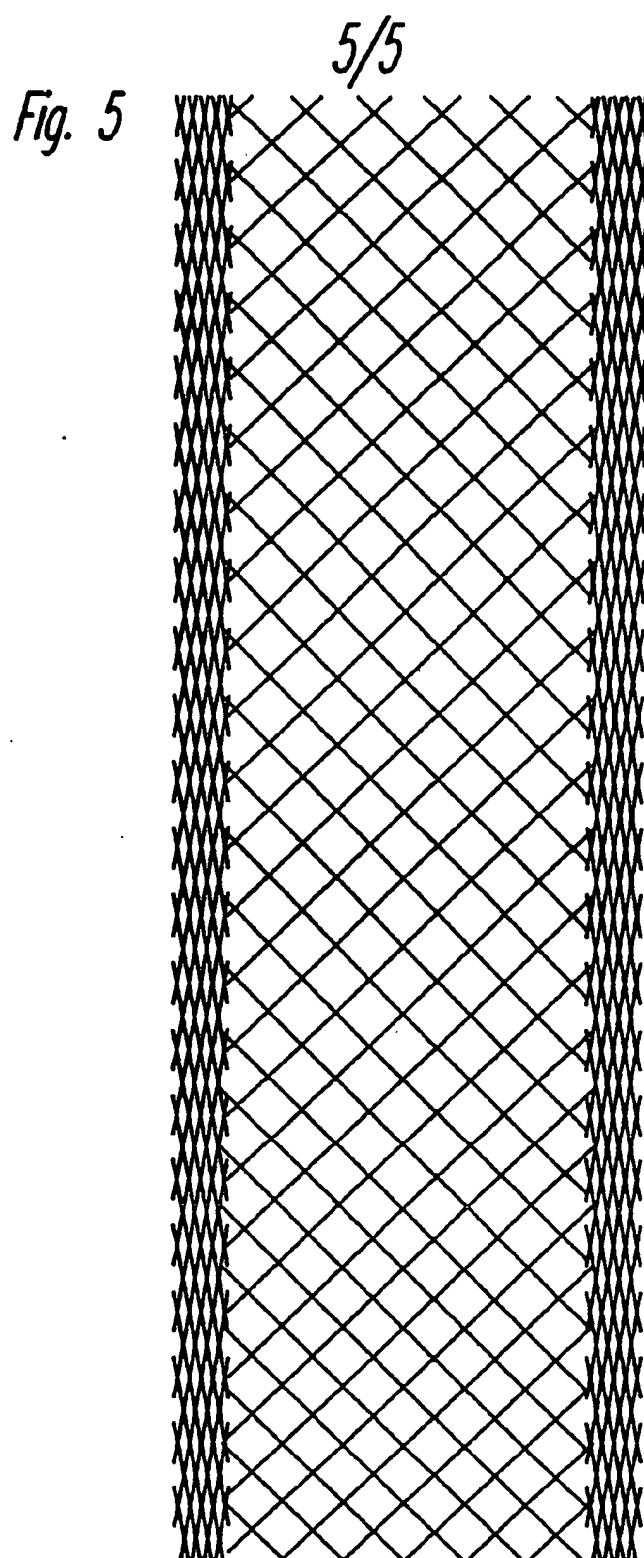


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Fig. 4





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INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 94/00328

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A01K 73/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A01K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 1745251 (JOHN W. ENRIGHT), 28 January 1930 (28.01.30)	1,3-4,6-8, 11-15,20-22
X	US, A, 5325619 (NELSON G. PAUL), 5 July 1994 (05.07.94)	1-4,7-8, 11-16,18, 20-22
A	WORLD FISHING, June 1969, "US design for "separator" shrimp", page 60-62	1-22

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

Date of mailing of the international search report

28 November 1994

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2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 94/00328

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB, A, 405405 (WILLIAM FAIRCLOUGH WRIGHT), 8 February 1934 (08.02.34) -- -----	1-22

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INTERNATIONAL SEARCH REPORT

Information on patent family members

29/10/94

International application No.

PCT/DK 94/00328

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 1745251	28/01/30	NONE	
US-A- 5325619	05/07/94	NONE	
GB-A- 405405	08/02/34	NONE	

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